

Mandibular Angulus Fracture Complicated by Inferior Alveolar Nerve Injury: A Clinical Case Report

Ni Nyoman Sintya Agniswari A P¹, Putu Trisna Utami²

¹Intern at Department of Plastic Reconstructive and Aesthetic Surgery, Bali Mandara General Hospital Bali, Indonesia

²Plastic Surgeon at Department of Plastic Reconstructive and Aesthetic Surgery, Bali Mandara General Hospital Bali, Indonesia

ABSTRACT

Background: Mandibular fractures especially in the angulus area are often accompanied by inferior nervus alveolaris (NAI) injury, resulting in significant complications in the form of sensory disturbances that reduce the patient's quality of life. Optimal management requires proper surgical technique and a thorough understanding of the anatomy and potential complications.

Case: A 40-year-old male patient presented with complaints of severe pain, facial swelling, malocclusion and trismus after falling into a gutter. Clinical and radiologic examination revealed a fracture of the left mandibular angulus with partial rupture of the NAI and avulsion of the lower third molar.

Methods: The patient underwent open reduction and internal fixation (ORIF) with double plate insertion and bone reconstruction with NAI preservation technique. Postoperatively, the patient showed good occlusion stability with no acute complications.

Discussion: Mandibular fractures of the angulus with NAI involvement have a high risk of neurosensory impairment. Recent literature shows a high prevalence of NAI injury in posterior mandibular fractures with variable recovery. Careful operative technique with a nerve preservation approach may decrease the risk of permanent impairment. Studies have also suggested the use of platelet-rich fibrin (PRF) as adjunctive therapy to accelerate nerve regeneration, although it was not used in this case.

Conclusion: This case emphasizes the importance of a careful surgical approach to mandibular angulus fractures with NAI injury. Education regarding the risk of neurosensory complications as well as nerve preservation strategies are key lessons that practitioners should take note of.

KEYWORDS: Mandibular fracture, mandibular angulus, inferior alveolaris nerve, open reduction internal fixation (ORIF).

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I. INTRODUCTION

Mandibular fractures represent a significant portion of maxillofacial trauma worldwide, but they carry a particularly high burden in Southeast Asia. In Indonesia, recent national data (2020–2024) indicate that mandibular fractures account for approximately 40% to 60% of all facial bone injuries, with Road Traffic Accidents (RTAs) primarily involving motorcycles being the causative factor in over 85% of cases (Septina et al., 2022).

In the specific context of Bali, the incidence is notably high due to the high density of two-wheeled transport and tourism-related mobility. Longitudinal studies at tertiary referral centers in Bali (e.g., Prof. Ngoerah General Hospital and Bali Mandara) suggest that the mandibular angulus is the second most common fracture site after the symphysis/parasymphysis, accounting for nearly 25.8% of mandibular injuries (Putra et al., 2023).

Biomechanical Vulnerability of the Mandibular Angulus is characterized by a unique biomechanical fragility. It

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serves as the transition zone between the horizontal body and the vertical ramus, where the bone is inherently thinner. This area is often described in recent literature as a "point of minimal resistance," especially when an impacted or semi-erupted third molar is present. The presence of a third molar reduces the cross-sectional area of bone, increasing the risk of fracture under blunt force trauma by up to threefold (Pappachan & Agrawal, 2020). During a traumatic event, the angulus is subjected to complex shearing and tension forces along Champy's lines, which often results in significant fragment displacement.

The Inferior Alveolar Nerve (IAN) The most debilitating complication of an angulus fracture is the involvement of the Inferior Alveolar Nerve (IAN), or Nervus Alveolaris Inferior (NAI). The mandibular canal, which houses the IAN, runs in close proximity to the lingual cortex of the angulus. When a fracture occurs in this region, the nerve is susceptible to primary injury via compression, traction, or in severe cases complete neurotmesis (rupture). Recent clinical cohorts (2021–2024) have demonstrated that the incidence of Neurosensory Disturbance (NSD) following displaced angulus fractures is alarmingly high, with some studies reporting pre-operative deficits in 90.1% of patients (Chandan et al., 2021). These deficits manifest as paresthesia, hypoesthesia, or dysesthesia of the lower lip and chin, which profoundly impacts a patient's quality of life, affecting speech, mastication, and social confidence.

While Open Reduction and Internal Fixation (ORIF) is the gold standard for restoring pre-traumatic occlusion and bone continuity, the surgery itself poses a secondary risk of iatrogenic nerve injury. The challenge for the maxillofacial surgeon lies in achieving "absolute stability" through rigid fixation without further compromising the already traumatized NAI. Modern paradigms (2024–2025) emphasize a neuro-protective approach, utilizing load-sharing mini-plate systems and atraumatic debridement techniques.

This case report details the management of a 40-year-old male in Bali who sustained a comminuted mandibular angulus fracture complicated by a partial NAI rupture. By synthesizing contemporary surgical techniques with a deep understanding of the Indonesian epidemiological context, this report aims to provide a comprehensive framework for preserving neurosensory function while ensuring stable osteosynthesis in complex mandibular trauma.

II. CASE ILLUSTRATION (CASE PRESENTATION)

A 40-year-old man presented to the emergency department of a referral hospital after an accident one day earlier. The patient complained of severe pain and swelling of the face, difficulty opening the mouth, and a bite that did not feel aligned. The complaint was accompanied by lacerations inside the oral cavity and abrasions on the face. According to the patient's statement, while walking to the shop at around 02:30 WITA, he was chased by a dog, then

ran and fell into a ditch with the left side of his face hitting the concrete wall of the ditch. Post-incident, the patient did not experience loss of consciousness, vomiting, or seizures. He was treated at Kasih Ibu Kedonganan Hospital and then referred to Bali Mandara Hospital for further treatment by the plastic surgery team.

On arrival at the hospital, the patient was fully conscious (GCS 15) with stable vital signs. Initial examination did not reveal any intracranial injury or neurological disorder. However, on facial inspection, there was deformity of the left mandible with oedema and tenderness. Multiple abrasions were found on the face and extremities. Intraoral examination revealed a laceration of the left mandibular gingival mucosa, with bony exposure, open bite malocclusion, trismus with a mouth opening limit of only about 1.2 to 1.5 cm, and subluxation of the left lower molar tooth. Crucially, during the physical examination, the patient reported a distinct sense of numbness over the left lower lip and chin area, strongly indicating a high clinical suspicion of an underlying nerve injury. Ophthalmologic examination showed no significant impairment.



Figure 1. The patient exhibited notable facial asymmetry characterized by pronounced facial edema on the left side with superficial abrasions and severe trismus.

Supporting examination in the form of a 3D CT scan of the head (Figure 5) showed no intracranial hemorrhage, but confirmed a comminuted fracture of the left mandibular angulus with surrounding soft tissue swelling. The 3D reconstruction visually raised high suspicion of pre-operative nerve damage: displaced bony shards and fractured cortical segments in the angulus region were seen sharply impinging upon the mandibular canal trajectory, particularly near the mandibular foramen. There was also deviation of the septum nasi to the left and left maxillary sinusitis. Thoracic X-ray showed results within normal limits. Laboratory results showed leukocytosis, mild hyponatremia, and elevated ureum and creatinine, suggesting the possibility of mild acute renal impairment.



Figure 2. Intraoral examination revealed over bite malocclusion.



Figure 3. Demonstrating a maximum interincisal mouth opening limited to approximately 1.2 to 1.5 cm.



Figure 4. Intraoral examination revealed a laceration of the left mandibular gingival mucosa, with bony exposure and partial NAI rupture, alongside subluxation of the left lower molar tooth.



Figure 5. The 3D reconstruction visually raised high suspicion nerve damage: displaced bony shards and fractured cortical segments in the angulus region were seen sharply impinging upon the mandibular canal trajectory, particularly near the mandibular foramen.

The surgical management of mandibular fractures can be approached either immediately or delayed. In this specific case, a delayed operative approach was elected. This decision was primarily driven by the clinical necessity to allow the severe acute facial edema to subside, coupled with logistical time constraints. After thorough medical preparation and explanation to the patient and family, informed consent for the operative procedure was taken. The patient was positioned in the supine position and given general anesthesia. The operative area was thoroughly disinfected and sterile dressing was applied.

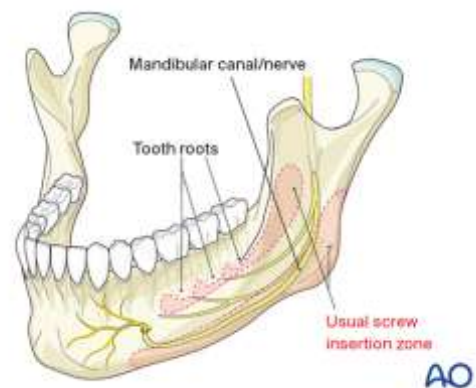


Figure 6. Anatomical illustration depicting the mandibular nerve (V3) entering the mandibular foramen to become the inferior alveolar nerve, coursing through the mandibular canal, and exiting at the mental foramen as the mental nerve. This highlights the vulnerability pathway during mandibular angle fractures.

An incision was made at the dental buccal sulcus from the left third molar area towards the mandibular ramus and a retromandibular incision for extraoral access to the mandibular angulus. During exploration, a comminuted fracture of the left mandibular angulus around the mandibular foramen was found. Figure 4 illustrates the complex intraoperative condition, specifically showcasing the deep mucosal laceration, bony exposure, and the direct clinical visualization of the partial rupture of the inferior alveolaris nerve. There was also a partially avulsed left third molar, and multiple lacerations in the facialis region.

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Figure 7. Picture of comminuted fracture of mandibular angulus (Intraoperative)



Figure 8. Partial rupture of the inferior alveolar nerve.

This was followed by mandibular reconstruction (Figure 9), beginning with evaluation of the fracture fragments and cleaning of the devitalized tissues. The remaining avulsed M3 tooth was odontotomies clean. The bone fragments were then repositioned keeping the inferior alveolaris nerve intact. Initially, an arch bar and temporary occlusion using a loop wire were placed to ensure a proper occlusion. Subsequently, the fracture fragments were manually repositioned and rigidly clamped using bone reduction forceps to achieve structural alignment prior to definitive fixation.



Figure 9. The bone fragments were then repositioned and rigidly clamped using bone reduction forceps to achieve definitive fixation and an arch bar using a loop wire (temporary) were placed to ensure a proper occlusion.

Bone fixation was performed using two plates. As depicted in Figure 10, the surgical access required an extraoral approach because endoscopic equipment was unavailable. Furthermore, a transbuccal trocar was utilized to facilitate screw placement due to the considerable thickness of the patient's masseter muscle. Due to the biomechanically unfavorable nature of the mandibular fracture, combined with financial and instrumental limitations, rigid fixation was achieved utilizing this dual-plate technique. The first plate was fixed to the linea obliqua superior to the mandibular angulus with a 5-hole plate configuration and three 6 mm screws and one 5 mm screw. The second plate was fixed to the inferior margo of the mandible using a 3-hole plate with four 12 mm screws. Despite these reduction efforts, it was noted that a minor segment of bone remained slightly bowing (towing) outward due to the severe pre-existing comminution and limitations in reconstructive hardware.



Figure 10. Bone fixation was performed using two plates.

After the bone position and occlusion were considered stable, the wound was sutured layer by layer and Barton bandage was applied as additional stabilization. Debridement of the facial laceration wound and primary suturing were then performed. The patient was transferred to the postoperative ward in stable condition. Supportive therapy was given, including intravenous antibiotics (ceftriaxone and metronidazole), analgesics, daily wound care with gentamicin ointment and sterile gauze, and cold compresses on the left cheek. The patient was given a non-chewable liquid diet high in calories and protein, and oral hygiene education with water gargle, tooth brushing twice a day, and oral antiseptic six times a day. Postoperative evaluation showed good fixation results with stable occlusion, without acute complications. The patient underwent follow-up observation and post-intervention rehabilitation as planned.it.

III.DISCUSSION

Mandibular angulus fracture is one of the most common and technically challenging injuries in maxillofacial trauma, mainly due to the involvement of complex anatomical structures such as the inferior nervus alveolaris (NAI). In this case, a left mandibular angulus fracture accompanied by

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partial rupture of the NAI due to blunt trauma demonstrated the anatomical vulnerability of the posterior region of the mandible and the accompanying surgical challenges.

The proximity between the NAI and the mandibular canal makes this nerve particularly vulnerable to injury in posterior mandibular fractures. Chandan et al. (2021) reported that up to 90.1% of mandibular angular fracture cases showed impaired NAI function at presentation, generally due to the fracture line crossing the neurovascular bundle. The intraoperative findings in this case—a partial rupture of the NAI in the angulus area—support this pattern. Despite attempts at anatomical preservation during reduction and fixation, manipulation of the fracture area remains at risk of causing additional nerve irritation or injury.

Open Reduction and Internal Fixation (ORIF) is the gold standard of management for mandibular angulus fractures that are displaced, comminuted, and accompanied by occlusion disorders or trismus (Pappachan & Agrawal, 2020; Alamgir et al., 2023). In this case, a dual-plate fixation approach in the superior linea obliqua and inferior margin of the mandible was chosen to provide three-dimensional reconstructive stability, especially due to the high mechanical load on the mandibular angular area. This strategy is in line with the recommendation of load-sharing osteosynthesis to minimize the risk of nonunion or implantation failure (Tahrir et al., 2021).

During the operative procedure, meticulous care was exercised due to the pre-existing nerve injury. It is crucial to clarify anatomically that the nerve supplying sensory function to the chin and lower lip is the mental nerve, which is a terminal branch of the inferior alveolar nerve (originating from the mandibular nerve, V3), rather than the maxillary nerve. Recent literature from 2020 to 2025 heavily emphasizes the necessity of neuro-protective strategies during such surgeries. Studies indicate that while Open Reduction and Internal Fixation (ORIF) provides essential rigid stability, it inherently carries a risk of iatrogenic injury to the inferior alveolar and mental nerves; however, careful dissection, atraumatic retraction, and ensuring that hardware placement avoids the mandibular canal can significantly mitigate permanent neurosensory deficits and facilitate robust functional recovery rates. Factors such as the degree of comminution, nerve involvement, avulsion of the third molar, and systemic conditions such as mild renal dysfunction (azotemia) in this patient greatly influenced the timing and strategy of surgery. Mundepi et al. (2024) mentioned that both closed and open approaches can provide equivalent nerve recovery outcomes when chosen appropriately. In this case, considering the fracture instability and impaired occlusion, an ORIF approach was the most rational choice.

Despite careful measures, NAI injury remains one of the major postoperative concerns. Sulistyani et al. (2022) reported that 44.4% of patients who underwent ORIF for

mandibular fractures experienced postoperative sensory disturbances, although the majority improved within 12 months. This suggests that the prognosis in such cases, where the nerve is only partially ruptured, is generally quite good. However, recovery times can vary so ongoing sensory monitoring remains an important part of postoperative care.

Interestingly, some novel adjuvants such as Platelet-Rich Fibrin (PRF) have been investigated to promote nerve regeneration. Tabrizi et al. (2024) showed that intraoperative PRF application around the NAI was able to accelerate sensory recovery in mandibular fracture patients. Although this technique has not been used in this case, it may be an option in the future, especially in cases of partial rupture that still have regeneration potential.

In these cases, radiologic evaluation was performed using CT scans to assess fracture complexity. However, a study by Burian et al. (2020) mentioned that high-resolution MRI can provide more accurate information on postoperative nerve integrity, and potentially aid in decision-making for advanced neurosurgical measures or long-term rehabilitation in cases of persistent sensory dysfunction.

This case highlights the importance of individually tailored treatment planning to ensure optimal management according to each patient's specific needs. Factors such as the degree of comminution, nerve involvement, avulsion of the third molar, and systemic conditions such as mild renal dysfunction (azotemia) in this patient greatly influenced the timing and strategy of surgery. Mundepi et al. (2024) mentioned that both closed and open approaches can provide equivalent nerve recovery outcomes when chosen appropriately. In this case, considering the fracture instability and impaired occlusion, an ORIF approach was the most rational choice.

CONCLUSIONS AND LIMITATION

The Mandibular angulus fractures with partial injury of the inferior alveolaris nerve (NAI) are a complex challenge in the management of maxillofacial trauma. This case emphasizes the importance of an individualized approach that considers fracture complexity, occlusion status, and neurovascular involvement. Open reduction and internal fixation (ORIF) with nerve preservation and dual-plate fixation techniques were shown to provide good structural stability and occlusion results. Although the risk of sensory impairment remains, the prognosis of partial NAI recovery is generally good with careful surgical technique and close postoperative monitoring. A multidisciplinary approach and comprehensive supportive therapy contribute to optimal clinical outcomes.

Ranging from resource constraints and the lack of endoscopic equipment to the clinical necessity of delayed intervention reflect the practical challenges often faced in specific surgical settings. These constraints underscore the importance of surgical adaptability and highlight the need

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for further longitudinal studies to evaluate long-term neurosensory recovery and structural outcomes in resource-limited environments.

ETHICS APPROVAL

Informed consent has been acquired from the patient. The patient written informed consent to be published as a case report.

COMPLETING INTERESTS

All the authors declare that there are no conflicts of interest

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